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ABSTRACT

This paper proposes concepts for the data inputs and informational outputs for the Instructional Support System for Occupational Education (ISSOE), which is a subsystem of the Comprehensive Instructional Management System for Occupational Education (CIMS/OE) currently being developed by the New York State Education Department for the purpose of collecting data to support educational managers in their planning and decision-making functions. The first section provides an overview of CIMS/OE and relates ISSOE to the other subsystems. Next, the two types of informational outputs are described in terms of student output information (including the student's progress record, achievement level reports, and employability profile) and program output information (covering data for cost-benefit and cost-effectiveness analyses). The types of input data are explained in the third section as follows: (1) the program classification system consisting of U.S. Office of Education codes and the classification of programs as single, multiple, or clustered student groups; (2) the skills the students learn and the proficiency level they achieve which is indicated by a numerical quality score; and (3) employability profiles for students. Appendix A shows examples of student output records while Appendix B discusses normative data for criterion-referenced tests. (ELG)

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PROPOSED CONCEPTUAL DESIGN FOR THE INSTRUCTIONAL SUPPORT SYSTEM FOR OCCUPATIONAL EDUCATION REPORTING SYSTEM

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INTRODUCTION

CONTENTS

	Page
INTRODUCTION	2
OVERVIEW OF TOTAL SYSTEM	4
Integrated Design	5
Data Base Design	5
Instructional Support System for Occupational Education	6
INFORMATION OUTPUTS	10
Student Output Information	10
Student Progress Record	10
Student Achievement Level Reports	12
Employability Profile	12
Program Output Information	12
Basis for Cost-Benefit Analysis	13
Basis for Cost-Effectiveness Analysis	14
DATA INPUTS (REPORTING PROCESS)	16
Program Classification System	16
Program Structure	17
USOE Codes	18
Single Student Group Programs	20
Multiple Student Group Programs	21
Clustered Student Group Programs	24
Federal Reporting	26
Enrollment by Tasks and Quality Scores	27
Employability Profiles	28
APPENDICES	
A. Figures	31
B. Normative Data for Criterion-Referenced Tests	33
REFERENCES	36

INTRODUCTION

The purpose of this paper is to propose concepts for the data inputs and informational outputs for the Instructional Support System for Occupational Education. As often happens in education the operational need for this system came into existence before the total system within which it is to operate was conceptually finalized. This subsystem, ISSOE (the acronym by which it is referred) has been previously specified but has encountered numerous design difficulties principally because of the fluidity of the conceptual design of the parent system.

Practical considerations persist and demand that a working model of ISSOE be formulated and tested for feasibility at an early date. This paper, therefore, describes a model for the ISSOE reporting system which was developed using the systems approach. That is, it was designed to provide informational support at the instructional level in a way that is compatible with the total system. If the systems approach is not taken at this point and ISSOE continues to be designed in isolation, its redefinition is likely to continue ad infinitum and will be accompanied by considerable frustration among the users and also considerable cost to the taxpayer.

This paper attempts to do three things:

(1) Provide an overview of the total system to show where and how ISSOE fits in,

(2) Provide conceptual descriptions of required informational outputs, and the data inputs from which they can be derived, and

(3) Present approaches for the solution of problems associated with the classification of programs, the reporting of data and the generation outputs such as employability profiles, progress reports and student report card information.

OVERVIEW OF TOTAL SYSTEM

OVERVIEW OF TOTAL SYSTEM

A management information system for occupational education, namely CIMS/OE[1] is currently under development by the New York State Education Department for the purpose of systematically collecting data to support educational managers in their planning and decision-making functions (Seckendorf, 1973). An enormously complex system, CIMS/OE is comprised of three major subsystems which are also in various stages of development and conceptual redefinition. Each of these subsystems is intended to generate information which will support decisions at different management levels. (See Reference 2 for a complete description of CIMS/OE.)

The orignial conceptual design of CIMS/OE specified these three major management information subsystems as:

(1) RESOE - the reporting and evaluation system for occupational education,
(2) ISSOE - the instructional support system for occupational education,
(3) TASOE - the targeting system for occupational education.

An updated version of the concept specifies the three major management information subsystem as:

(1) OERS - occupational education reporting system
(2) ISSOE - the instructional support system for occupational education,
(3) (EIS) - employment information system.

The types of decisions which are intended to be supported by such a systems concept are infinite in as much as the design is totally flexible and intended to generate informational outputs requested to support any management inquiry at hand. For example, at the upper end of the management hierarchy, the Commissioner of Occupational Education has the responsibility for determining the most effective expenditure of public funds for the public good. Mechanisms

[1] CIMS/OE is an acronym for Comprehensive Instructional Management System for Occupational Education.

for providing information to support decisions at this level include cost-effectiveness, cost-benefit, cost impact analyses as well as others. At the other end of the management hierarchy, teachers and guidance counselors have the responsibility for deciding what competencies are best suited for individual students to learn in order for them to maximize their employment potential. This same system provides the information necessary to support these decisions. Similarly, at all other intermediate management levels, information which is needed to support the inquiry at hand is generated from the same data base at the request of the decision-maker.

Integrated Design

The distant goal in the development of CIMS/OE is that of an integrated design. That is, the various operating information systems of SED and school districts are to become integrated subsystems of the total management information system. The advantages of an integrated design are economy, efficiency, effectiveness and control. This total information system can be a combination of management information subsystems such as ISSOE and operational information subsystems such as payroll systems. A payroll system that produces paychecks for teachers is classified as an operational information system but if payroll data is utilized to determine program costs or to perform labor analyses it is considered part of the management system.

A major feature of an integrated information system is a common data flow. (O'Brien, 1975.) This is the use of common input, processing, and output procedures where it is feasible. An optimum systems design collects data only once as close to the original source as possible. An optimum system also utilizes a minimum of data processing procedures and subsystems to process the data and to minimize the number of output documents. For example, as many student characteristic data as possible should be captured at the time the student enrolls in a particular school so that the data will not be again requested from school psychologist, teacher, or staff member at a later time. This kind of integration avoids duplication, simplifies operations and produces an efficient system.

Data Base Design

The major characteristic of integrated information systems is a common data base which eliminates duplication in storage and retrieval of data and information. The data base consolidates and integrates data records that are stored in many separate data files. (O'Brien, 1975.)

In the conceptual design of CIMS/OE, OERS is specified as a flexible data base to support federal and State mandated reporting requirements and to also support ISSOE and EIS. It consists of disaggregated census data for all school systems offering occupational programs in the State of New York. It includes all of the data required by the U.S. Office of Education Annual Federal Report for Occupational Education and by the State of New York upon which school reimbursements are based. The data types include: student enrollment and completors by programs, school staff, expenditures, instructional objectives by program, and facilities.

Instructional Support System for Occupational Education

An integral part of comprehensive management information system, ISSOE is primarily intended to support decision-making by teachers and counselors in meeting the needs of students in their pursuit of employability. It also contains data that supports decision-making at other management levels. (See Reference 4 for a complete description of ISSOE.)

The proposed information structure of ISSOE is designed to support decision-making at the teacher level in the following ways: (1) It is required to support the counseling process by providing for the matching of student characteristics and interests to occupations for which they are best suited; (2) It is required to generate employability profiles for individual students by way of delineating the skills which they have acquired by job title and also their level of achievement; (3) It is required to provide the basis for updating skills offered to ensure that the needs of business and industry are being addressed. Modularized occupational curricula is at the heart of the informational structure to meet these requirements.

Modularized curricula developed as an integral part of ISSOE specify job skills as intended learning outcomes and are structured in a way that provide the basis for individualized instruction. With definitive skills specified in the modules as major objectives and with enabling objectives to achieve them delineated, the basis for matching student cognitive styles to available methods of instruction is at hand. A record of major objectives achieved by the student provided the basis for employability profiles. This requires that major objectives be linked to job titles described in the Dictionary of Occupational Titles (D.O.T.). In addition, the record of what skills students can perform at program completion can be used to discuss more objectively with employers (1) if skills being taught are valid, (2) if obsolete skills are being taught, (3) if skills are not being taught which should be in order to keep up with technological changes and, (4) if acceptable levels of performance are being met.

This data also provides for the determination of program effectiveness and cost-effectiveness which is essential to upper echelon decision-makers. When merged with USOE codes (Reference 5) and with coded job titles and worker trait groups (Reference 6) the process of targeting occupational education programs to occupations also becomes more effective.

The conceptual design of ISSOE proposed herein related the skills which are specified within curriculum modules which are acquired by students to the occupational code system of the U.S. Department of Labor (D.O.T. Codes) and to instructional programs described by USOE codes. The design accommodates the diversity of program structures as they exist in the field by permitting an accurate clustering of skills by programs and by enrollment.

The balance of this paper focuses on the key concepts of informational outputs and the data inputs necessary to generate them. The order of presentation is output to input. That is, the outputs that are viewed as being useful to teacher decision-making and also to upper echelon management decision-making are discussed first.

After identifying types of outputs; data inputs necessary to generate them are described.

Before proceeding it would be useful to point out the distinction being made between 'data' and 'information'.

> The terms 'data' and 'information' are often used interchangeable. However, a distinction should be made between the two. Data should be viewed as the raw material which is processed into the finished product of information. Information can be defined as data that has been transformed into meaningful and useful form for specific human beings. In some cases data may not require processing before constituting information for a human user. However, data is usually not useful until it has been subjected to a process where its form is manipulated and organized and its content is analyzed and evaluated. Then it becomes information.
>
> What is the difference between data and information?
>
> 382436, that's data.
>
> 38-24-36, that's information.[1]

[1] Charles Wadsworth, The Orlando (Fla.) Sentinel (April 12, 1971), p.6

INFORMATION OUTPUTS

INFORMATION OUTPUTS

The following sections describe the form into which data collected from school managers can be arranged into useful information outputs. Desired outputs for the students, teachers and employers are defined first, then those which would be useful to upper echelon managers. The idea of presenting outputs at both ends of the management hierarchy is to illustrate how data collected once at one management level can be used to support outputs at other levels. The considerations in determining what data is collected at what level are (1) where the most accurate data can be generated and (2) the minimization of the amount of data reported for any one level by distributing the data collection activity across all management levels. Systems analyses of school districts in Massachusetts have shown that some data is collected as many as sixteen different times from several different administrators to satisfy various reporting requirements. (Kyros, 1975.) If a similar situation exists in New York an optimally designed data collection process to satisfy CIMS/OE should result in a reduction of data reporting activities by incumbent managers and/or teachers and not an increase.

Student Output Information

Outputs which can provide information that can be utilized by students, teachers and employers include (1) student progress records (2) achievement level reports (from which report cards can be automatically generated) and (3) employability profiles.

Student Progress Record - Figure 1, p. 31, illustrates an individual progress record from which outputs (2) and (3) can also be generated without any additional data input by the teacher. This output answers the following questions:

1. What is the student's name and for what occupation is he/she being trained?
   The response is given in lines (1) and (2) and is based on conferences among the student, counselor, and teachers. The evaluation of the student's interests and activities and labor market demands result in directing the student to target the occu-

pation or occupation cluster to which he/she is best suited. The occupations are designated by D.O.T. codes which are currently utilized by the New York State Employment Service in their listings of job opportunities.

2. What tasks has this student acquired and how well can he/she do them?
   The response is given in line (3) which delineates all of the tasks which he/she has attained to date. The tasks are those specified in the modules and the quality scores are those assigned by the instructor. The central notion of quality scores is to measure the quality of the student's performance, i.e., the output product. The combination of the quality score and the number of students completing the module are essential to the evaluation of the program. Appendix B, p. 33, discusses the problem of acquiring comparative data upon which management decisions can be made regarding program evaluation and upon which employer's decisions can be made regarding the employability of the student. A solution to the problem is offered in the Appendix.

3. How well can the student perform in the chosen occupation?
   Line (4) provides a cumulative score which answers this question and automatically generates student report cards in any format required by the local school system.

4. What additional tasks does the student have to master in order to qualify for the target occupation?
   Line (5) enumerates the tasks by module which the student needs in order to complete the requirements for the target operation.

Student Achievement Level Reports - Quality scores to reflect student achievement level can be derived by the assignment of numerical values to any existing subjective or quantified system which is currently in place in the local school system. For example, if a school system utilizes a five level rating system to report on student performance, as (1) fair, (2) satisfactory, (3) good, (4) excellent, and (5) superior, the numerical values 1 through 5 can be assigned to generate a score for each module or skill. Numerical values are not only easier for the computer to manage but they are essential for the application of program effectiveness, cost-effectiveness and cost-benefit techniques.

Employability Profile - An employability profile is a listing of all of the occupations for which a student is qualified. Ideally it would include a listing of the tasks which the student is able to perform and an indication of how well he/she can perform them. (See Figure 1, p. 31.)

Program Output Information

This section describes in broad terms the nature of the CIMS/OE information outputs that are required by managers of occupational education other than teachers to evaluate programs for purposes of policy and decision-making.

The data base (OERS) provides a complete description of the inputs to occupational education in New York by collecting expenditure and non-expenditure data. (OERS) provided: staff and enrollment information which can be used to generate pupil/teacher information; facility utilization of student class time to determine the mix of academic and occupational education in a program. In terms of expenditure inputs to occupational programs, current and capital costs of training are available in terms of total costs, per department (or program) total costs per pupil, and also supportive and instructional costs per department are available as totals and per pupil basis.

In addition to the inputs to occupational education, job entry skills (TASKS) which can be used to describe educational outputs

have been developed as an integral part of CIMS/OE. These outputs are described in curriculum modules, which when related to programs described by USOE codes makes possible a convenient description of educational outputs which is compatible with the federal reporting system for occupational education. When this information is merged with financial data, program evaluations can be made between schools or school systems on many levels.

The following example demonstrates how OERS integrated with ISSOE, i.e., the modular concept of specifying outcomes provides a solution to the problem of providing an accounting to the public. With these two subsystems of CIMS/OE operating integrally it is possible to demonstrate that occupational education yields results consistent with the goals that society has set for it. Hypothetically, let us consider two schools. Each offers an auto mechanics program designed to meet local manpower needs by utilizing the CIMS/OE employment subsystem. Although each school consistently graduates the same number of students, it costs the first school 30 percent more per pupil to produce a graduate.

The citizens and school committee in the first school district know only that it costs 30 percent more than the other community to turn out an auto mechanic, and they are justified in questioning the cost difference. They may question whether their school is being managed efficiently, if the money expended is being used effectively, and if their graduates are better prepared.

Basis for Cost-Benefit Analysis - Under present conditions there is no way for the school to justify its higher cost, or for the State Education Department to evaluate the program against the expenditures. By using the modules, however, it can be demonstrated that the auto mechanics program completors can perform 50 entry-level skills as compared to 35 in the other school and that it accommodates a number of main-streamed disadvantaged students in the program who require special equipment, special teachers, and special attention. By following up its graduates, the higher-cost school can show that more of its graduates find jobs, earn more, and return $7 for every dollar invested in them as compared to the other school.

The stage is now set for a cost-benefit analysis to determine if the educational outcomes are worth the additional expense. The last point is an important one for it would be an obvious advantage to the occupational education manager if it could be determined that what the student learns in the classroom is clearly connected to the positive effects that he/she ultimately has on society. These positive effects, both economic and non-economic, would include such factors as productivity in terms of employment, production of goods and services, and tax revenues, as well as the student's contribution to the family and society.

It should be noted that cost-benefit analyses can be included in CIMS/OE as a longitudinal study performed on a sampling basis to provide indicators of the impact of the student on society over time.

Basis for Cost-Effectiveness Analysis - A record of module achievement by students within an occupation combined with information describing differential career patterns of graduates over several years would be useful input to policies governing the substance of occupational education for future waves of students. With program goals specified by objectives (prescribed wtihin the modules) definitive job-entry skills that students demonstrate upon graduation can be more objectively discussed with advisory councils, employers and lay citizens.

Because of their structure, the modules can be used as the basis to determine program effectiveness and also cost-effectiveness. Testing against the major objectives with quality scores generated on a 1 to 5 scale can be used to determine the achievement level of students for each job-entry skill offered. This represents an important development in the evaluation of occupational programs in terms of student achievement.

It is noted that the determination of student achievement levels and the generation of quantitative results with dispersion characteristics are critical to the evaluation of occupational programs. From a technological viewpoint the issue is not whether student grade scores are essential to CIMS/OE but what methodologies should be applied to acquire such data. (Appendix B.)

DATA INPUTS (REPORTING PROCESS)

DATA INPUTS (OR REPORTING PROCESS)

The teacher inputs necessary to generate specified informational outputs is required to be minimal and, if possible, be designed in a manner which will reduce the current paperwork load. The design offered below satisfies these requirements in that it requests only four data types from teachers. These data include:

1. Program classification by USOE code (which is a one-time requirement)
2. The name of the student
3. The code number of the tasks completed
4. The achievement score on the tasks completed

The reporting of these data will generate for the teacher and the student:

1. The student progress chart
2. The student report card
3. An employability profile

These data inputs when aggregated by the computer and when merged with financial data and D.O.T. codes will be included in the informational outputs required to support program decisions by upper echelon school managers and those of the State Education Department which were discussed in the previous section. It is noted that D.O.T. codes are not required to be inputed by teachers.

Program Classification System

A system of accurately classifying programs by numerical means is necessary in order to manipulate the data for the generation of the specified informational outputs. The main consideration in the design of such a system is to define a methodology that can accurately describe the program as it is being offered. Since programs that are offered across the State carry similar word titles but are structured differently and contain different content, the teacher is best able to provide the most accurate descriptors. The following method which was developed by the MISOE, a project of the Massachusetts Department of Education, can be adapted to meet ISSOE data input requirements.

Program Structure - Occupationally-oriented programs are structured in two distinct ways. In general, program structure in city vocational-technical schools and BOCES centers differs from that of many regular high schools, comprehensive schools, and community colleges.

Most BOCES schools and community colleges in New York use a structured or "tracked" system of instructing their students. A mandatory sequence of courses is prescribed for each occupational area in which students are trained. This sequence of courses ensures that each student is enrolled in a complete instructional program, and it is assumed that the program will provide the student with all the required job-entry skills. For example, students enrolled in the Woodworking Department acquire the job-entry skills for carpentry and cabinet-making. In order for a student to successfully complete this program in either carpentry or woodworking, he is required to follow a prescribed course sequence established by the school.

Regular high schools and comprehensive schools often differ in their program structure. These programs may be offered to students on an "untracked" basis. In an "untracked" program, students are not required to follow a prescribed course sequence. In many schools a course sequence is recommended for preparation in specific occupational areas, but a student is not bound to follow it. For example, a student enrolled in the Business Education Department may want to acquire a job-entry skill for an occupation as a secretary. The school's Business Education Department recommends a specific course sequence to be followed over a three-year period. However, the student may elect to follow the suggested sequence, or may elect to follow his/her own. In the latter case, the sequence of courses chosen can usually be used to define the student group into which he/she falls, i.e., whether the student emphasizes bookkeeping or stenography or secretarial, or general office skills, etc.

USOE Codes - Codes have been developed by the U.S. Office of Education for the purpose of providing accurate and comparable information about vocational instructional programs in the United States and its territories. These codes are connected to definitions for instructional programs and are currently used by USOE for collecting, recording, interpreting, and transmitting meaningful data about enrollments, graduates and placements at the local, State, and national levels.

It would be inefficient for New York State to devise a classification system of its own when one already exists which is applicable. Therefore the method offered below utilizes USOE codes to describe occupational programs of instruction as they exist in New York State. The method connects program descriptors to enrollments, to job-entry skills acquired, to occupations for which they are being trained. This inter-relationship forms the basis for all of the outputs previously described.

The USOE Code System describes seven major occupational areas of instruction. Each is identified by the two digits to the left of the decimal point of a six (or eight) digit code number, as follows:

01 Agricultural Occupations	09 Home Economics Occupations
04 Distribution and Marketing Occupations	14 Office and Business Occupations
07 Health Occupations	16 Technical Occupations
	17 Trade and Industrial Occupations

Numbers to the right of the decimal point describe increasing occupational specificity by which to classify students enrolled in instructional areas, for example:

First 2-digit position:
14 OFFICE OCCUPATIONS
Second 2-digit position:
14.02 BUSINESS DATA PROCESSING SYSTEMS OCCUPATION
Third 2-digit position:
14.0202 PERIPHERAL EQUIPMENT OPERATORS
Fourth 2-digit position:
14.020201 KEYPUNCH & CODING EQUIPMENT OPERATORS

Six-digit numbers are usually sufficient to classify most instructional programs in the State.

While USOE Code numbers identify instructional areas, they do not necessarily represent administrative units such as departments. For instance, a particular school may offer a woodworking curriculum, administrated by a woodworking department, which instructs students to be carpenters and cabinet-makers. In such a situation, two USOE Codes are necessary to accurately identify the instructional areas or student groups: 17.1001 for carpentry and 17.3601 for cabinet-making.[1] The remainder of this section describes how students in instructional occupational programs (as they are offered in New York) can be accurately classified by USOE Codes.

Students enrolled in Occupational Education programs can be coded by three distinct methods in order to accurately describe instructional areas as they are offered. These methods are: 1. The Single Student Group Method, 2. The Multiple Student Group Method and 3. The Clustered Student Group Method. They are described below.

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[1] These code designations are not of sufficient specificity to include all of the actual occupations for which students would qualify. For example, an instructional area classified as 17.3601 "Millwork and Cabinetmaking" may qualify a program completor for employment as a furniture assembler, tenoner operator, patternmaker and many others depending on the specific job-entry skills learned during the educational experience. In view of this, it is necessary to relate D.O.T. Codes, titles, and worker trait groups with the USOE Codes and titles of the educational programs in order to establish a connection between demand and supply information.

Single Student Group Programs - A single student group program is defined by a situation where all students are offered the same course sequence throughout the entire program. They are all prepared for the same occupational area(s) and they all receive training in identical job-entry skills modules. A single student group may receive training which could be described by one or several USOE Codes.

For example, consider an Automotive Mechanics Program which includes learning experiences as described by the following USOE Code:

"17.0302 AUTOMOTIVE MECHANICS

Learning experiences concerned with the components of the vehicle, including engine, power transmission, steering, brakes and electrical systems. Included is training in the use of diagnostic and testing equipment and tools used in the repair process."

If all of the students in this program are offered the same learning skills, as defined by modules, it is considered to be a single student group program described by one USOE Code. Its enrollment would be represented by grade as follows:

GRADE	10	11	12
USOE CODE	17.0302	17.0302	17.0302
ENROLLMENT	60	58	55

In certain instances, two USOE Codes may be required to more accurately describe the instructional area. For example, if within this automotive mechanics program job-entry skills in engine tune-ups were emphasized so that program completors would qualify as tune-up specialists in addition to general auto mechanics, the following description by USOE Code provides a better description of the program.

"17.0303 AUTOMOTIVE SPECIALIZATION

Learning experiences which emphasize more detailed training in the adjustments and repair of individual components and systems of the automobile, such as radiator, transmission, carburetor and brake system to achieve greater proficiency in the servicing of selected components."

The enrollments by grade would then be represented as follows:

GRADE	10	11	12
USOE CODE	17.0302 17.0303	17.0302 17.0303	17.0302 17.0303
ENROLLMENT	60	58	55

Note that all students still receive identical training throughout the program.

Multiple Student Group Programs - A multiple student group program is defined by a situation where students are offered training in several occupational areas, but where not all students receive identical training throughout the program. Different course sequences are followed by groups of students within the program. They are, therefore, acquiring job-entry skills (modules) which will prepare them for several distinct occupations. Student groups of this kind are identified at the beginning of the program and remain static to its completion. For example, consider a Graphic Arts Program which includes learning experiences as described by the following USOE Codes: Composition, Make-up and Typesetting (17.1901), Printing Press Occupations (17.1902) and Lithography, Photography and Platemaking (17.1903).

"17.1901 COMPOSITION, MAKE-UP AND TYPESETTING

Organized learning experiences concerned with layout, composition, make-up and hand and machine typesetting and typecasting."

"17.1902 PRINTING PRESS OCCUPATIONS

Organized learning experiences concerned with making ready, operating and maintaing printing presses."

"17.1903 LITHOGRAPHY, PHOTOGRAPHY & PLATEMAKING

Organized learning experiences concerned with lithography, lithographic photography, stripping, and related platemaking processes."

The program is structured so that students may opt for training in one or more occupational areas within the program. It is therefore considered to be a multiple student group program and the enrollment would be represented as follows for each grade level:

GRADE	10			
USOE CODE	17.1901	17.1092	17.1903	17.1901 17.1902
ENROLLMENT	25	25	25	25

GRADE	11			
USOE CODE	17.1901	17.1902	17.1903	17.1901 17.1902
ENROLLMENT	25	24	23	24

GRADE	12			
USOE CODE	17.1901	17.1902	17.1903	17.1901 17.1902
ENROLLMENT	20	24	22	23

This example indicates that of the 100 students enrolled in the program in the tenth grade, twenty-five are receiving instruction in Composition, Make-up and Typesetting (17.1901), twenty-five in Printing Press Occupations (17.1902), twenty-five in Lithography, Photography and Platemaking (17.1903), and twenty-five are receiving instruction in the two occupational areas, Composition, Make-up and Typesetting (17.1901), and Printing Press Occupations (17.1902). The same structure applies for the eleventh and twelfth grades with the decrease in enrollment due to attrition. Note that the student group did not change throughout the program.

If this program were structured so that all students were receiving instruction in all three areas throughout the program, it would be a single student group program with a multiple code.

The enrollment would be described as follows:

GRADE	10	11	12
USOE CODE	17.1901 17.1902 17.1903	17.1901 17.1902 17.1903	17.1901 17.1902 17.1903
ENROLLMENT	100	96	89

As a further example of a multiple student group program, consider a Graphic Arts Department that includes significant instruction in the commercial art field and when, upon completion, a student is capable of performing skills as a commercial artist. Let it be assumed that this hypothetical department divides its students in the tenth, eleventh and twelfth grades into two groups, the Graphics Arts student group and the Commercial Art student group.

It is determined by the teacher that the USOE Code numbers that best describe the Graphic Arts Group are 17.1901, 17.1902,

and 17.1903 and that the Commercial Art group are best described by the following USOE Codes: 17.0700 (Commercial Arts Occupations), 17.0701 (Interior Decorator).

"17.0700 COMMERCIAL ART OCCUPATIONS

Organized specialized learning experiences which include theory, laboratory, and shop-work as they relate to the design and execution of layouts and making illustrations for advertising, display and instructional manuals. Instruction includes advertising, theory and preparation of copy, lettering, poster design, fashion illustration, silk screen, air brush and touch-up, inks and color dynamics, package and product design, drawings for line and halftone reproduction, and other display devices and exhibits."

"17.0701 INTERIOR DECORATING

Organized learning experiences concerned with the application of art principles to the design, selection, and arrangement of materials and objects in interiors of residential and commercial structures, and in shops and aircraft to achieve aesthetic effects or as a media for conveying ideas."

This also is a multiple student group program and the enrollment would be represented as follows for each grade level:

GRADE	10		11		12	
USOE CODE	17.1901 17.1902 17.1903	17.0700 17.0701	17.1901 17.1902 17.1903	17.0700 17.0701	17.1901 17.1902 17.1903	17.0700 17.0701
ENROLLMENT	25	25	23	23	20	20

Clustered Student Group Programs - A clustered student group program is defined by a situation where the program is structured so that the students are broadly grouped in the lower grades,

receiving training in job-entry skills (modules) for a wide variety of occupations, and in the higher grades they are regrouped according to the specific occupational areas in which they have selected to receive training. In a clustered situation the number of student groups increases from the lower to the higher grades. The key to recognizing the difference between a multiple and a clustered program is that in the multiple situation the groups remain static throughout the program, while in the clustered situation the groups are fluid. A student has the option to choose a more highly specialized group as he/she progresses through the program.

For example, consider a Business/Office Education Department which offers learning experiences described by the following USOE Codes: 14.0100 (Accounting & Computing), 14.0300 (General Office/Clerical) and 14.0700 (Stenographic, Secretarial & Related).

"14.0100 ACCOUNTING AND COMPUTING OCCUPATIONS

Planned learning experiences which include a combination of courses and practical experiences concerned with systematizing information about transactions and activities into accounts and quantitative records, and paying and receiving money."

"14.0300 FILING, OFFICE MACHINES, AND GENERAL OFFICE CLERICAL OCCUPATIONS

Planned learning experiences which include a combination of courses and practical experiences concerned with making, classifying, and filing records, including written communications."

At the beginning of the program (ninth or tenth grade), the students are grouped together taking courses that are common to all occupational areas of specialization. During the next two or three years, their training becomes more specialized as they concentrate on one or more areas of preparation. The following presents the enrollment data for the program just described:

GRADE	9	10	11		12		
USOE CODE	14.0100 14.0300 14.0700	14.0100 14.0300 14.0700	14.0100	14.0300 14.0700	14.0100	14.0300	14.0700
ENROLLMENT	100	150	50	75	25	25	25

This example indicates that in the ninth and tenth grades, all students are in the same multi-coded student group receiving instruction that could lead to any of the three areas of specialization. In grade 11, however, fifty students have elected to concentrate on courses that would qualify them as accountants (or bookkeepers) 14.0100, while seventy-five students are taking courses that would provide them with skills in general office clerical work 14.0300, and in the same stenographic and secretarial area 14.0700. In the final grade, all students concentrate in one area of specialization.

If a Business/Office program is structured so that all students are receiving instruction in all three areas throughout the program, it would be a single student group program with a multiple code. The enrollment would be described as follows:

GRADE	9	10	11	12
USOE CODE	14.0100 14.0300 14.0700	14.0100 14.0300 14.0700	14.0100 14.0300 14.0700	14.0100 14.0300 14.0700
ENROLLMENT	100	150	125	75

Federal Reporting - It is emphasized if enrollments in New York State occupational programs are classified by USOE Codes and stored in a computer, the Annual Federal Report for Occupational Education which is required by USOE can be generated automatically. This is another example of how data properly coded to accurately represent reality can be inputed once and serve to generate several reports.

Enrollment by Tasks and Quality Scores

This section describes the data inputs which are necessary to provide: (1) more precise instructional direction for the teacher and student, (2) the data for employability profiles, and (3) the basis for determining program effectiveness.

In the previous section methodologies were presented which can accurately describe programs and enrollments through the use of USOE codes and the concepts of grouping students to target occupational areas. However, targeting occupations does not provide sufficiently precise direction upon which instruction can be focused. The rationale behind the specification of clear, unambiguous major objectives within the modules is to provide such clear direction for the teacher and the student towards the attainment of the desired occupation. In other words, it is not possible to teach to an occupation, it is necessary to teach to the skills which constitute the occupation. These skills are included in the modules as intended learning outcomes and they represent the heart of the Instructional Support System.

The data input by teachers is contained in Figure 1, p. 31. The teacher reports the student's name (line 1), a record of modules passed (tasks acquired, line 2). The teachers are also required to classify their programs by USOE code. This is a one-time determination which depends on the structure of their program and the modules being offered.

The delineation of the modules acquired provide the basis of the employability profiles. It is virtually meaningless to say that this student has completed a program in auto mechanics without specifying the skills which can be performed and how well they can be performed. It is obvious that the degree of proficiency which a student exhibits in the performance of skills has a bearing on his/her employability. The degree of proficiency is customarily reported in the form of letter grades in most schools and is intended to reflect how well the student has performed. These letter grades can easily be translated into numerical quality scores.

The basis for determining the effectiveness of the program is tied in to student quality scores. These scores essentially measure the discrepancy between the intended learning outcomes and the actual learning outcomes.

Employability Profiles

Employability profiles are statements which answer the questions:

1. In what occupation has this student been instructed?
2. What skills can he/she perform?
3. How well can he/she perform them?

The data input to generate employability profiles is not a demand on the teacher since it is simply a matter of relating the modules that are relevant to the occupations being targeted. This is a one-time input, periodically up-dated, which connects module codes with D.O.T. codes. This data is then merged by the computer with the data input previously provided by the teacher to produce Figure 2. The system design proposed responds to the current practices of the New York State Employment Service which lists and stores available occupations by D.O.T. codes. The job-hunting student, knowing the D.O.T.s for which he/she is suited and trained, is able to scan tapes to locate prospective employers.

APPENDICES

APPENDIX A

FIGURE 1 - Student Progress Record and Achievement Level Report

FIGURE 2 - Student Employability Profile

FIGURE 1: STUDENT PROGRESS RECORD & ACHIEVEMENT LEVEL REPORT

1.	STUDENT NAME	JOHN SMITH
2.	D.O.T. CODE	Brakeman 620.281-034
3.	TASKS ACQUIRED & Q SCORE	1. R & R Brake Shoes (3.0) 2. R & R Parking Brake Cable (3.1) 3. R & R Disc Brake Caliper (2.1) 4. R & R Brake Lines (4.2)
4.	CUM Q SCORE	3.2
5.	TASKS REQUIRED TO QUALIFY & MODULE NO.	5. R & R Wheel Cylinder (18) 6. R & R Master Cylinder (19) 7. R & R Power Brake Assist (20)

FIGURE 2: STUDENT EMPLOYABILITY PROFILE

1.	STUDENT NAME	JOHN SMITH
2.	D.O.T. CODE	Brakeman 620.281-034
3.	TASK ACQUIRED & Q SCORE	1. R & R Brake Shoes (3.0) 2. R & R Parking Brake Cable (3.1) 3. R & R Disc Brake Caliper (2.1) 4. R & R Brake Lines (4.2) 5. R & R Wheel Cylinder (4.0) 6. R & R Master Cylinder (3.9) 7. R & R Power Brake Assist (4.1)
4.	CUM Q SCORE	3.5

APPENDIX B

Normative Data for Criterion-Referenced Tests

APPENDIX B - Normative Data for Criterion-Referenced Tests

Purpose:

The purpose of this appendix is to address the problem encountered in the application of criterion-referenced tests in ISSOE and to offer an approach to its solution.

Statement of the Problem:

Briefly stated, the demand for comparative data upon which decisions can be made about the quality of performance of a student is not satisfied by the current criterion-test measures that are specified in the Automotive Mechanics modules.

Presently a method is used which is intended to indicate whether a student has met minimum entry level performance for a given major objective which represents a job competency. While this is sufficient to describe what a student can do at the completion of a module, it does not indicate how well the student can perform. This deficiency causes three distinct problems.

The first problem is related to the grading systems employed by the local schools which require letters to be assigned to each student. Letter grades cannot be derived directly from the simple acceptable performance approach.

The second problem is concerned with the employer who wishes to know how well, or how proficient, a student can perform a given configuration of competencies that qualify the student for a particular occupation. For example, John may have passed objectives (or modules) 1, 2, and 3 which indicates that he has achieved minimum entry level requirements for the position of Front End Man. In fact, John can perform these three skills in twice the flat rate time. Mary, on the other hand, can also perform the same three skills but can do so within flat rate time. It is evident that the level of proficiency of each student is important information for the employer to know but it cannot be supplied by the existing system.

The third problem which arises is one of concern to the program evaluator who wants to know how well the students should be doing.

Under the present system the Auto Mechanics program has identified 117 competencies stated in the form of major objectives (Intended Learning Outcomes) which provide the basis for criterion-referenced testing. At the end of the program a given school would report that 80 percent of the students mastered Module 1, and that 60 percent of the students have mastered Module 2, etc. If Module 1 were a particularly difficult one, the 80 percent figure would conceivably indicate that the school was doing a good job. However if Module 2 were an easy one, the 60 percent figure would reflect instructional failure, not success.

These deficiencies are real ones, but they can be accommodated by designing criterion-referenced tests that also yield normative data.

Proposed Solution

The design of criterion-tests yielding normative data has been previously suggested (Popham, 1976 and Kyros, 1975.) as a means of providing increased descriptive power. It is suggested that testing against locally opted objectives with quality scores developed on a 1 to 5 scale can determine achievement and quality level for each job-entry skill offered. The following is suggested: (1) fair, (2) satisfactory, (3) good, (4) excellent, and (5) superior. Popham observes that, "with properly constituted comparative data, criterion-referenced tests can even be a great boon to educational evaluators."

The proposed solution therefore is to include criterion-referenced measures in each module that will provide the basis for generating both kinds of data while at the same time maintaining validity and reliability.

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